

What is claimed is:

1 1. Interferometric apparatus comprising:  
2 means for defining a reference frame;  
3 a translation stage;  
4 an electro-mechanical arrangement for selectively translating said translation  
5 stage in at least one of at least two orthogonal directions with respect to said  
6 reference frame;  
7 at least one thin, elongated mirror mounted in a predetermined manner with  
8 respect to said reference frame, said at least one thin, elongated mirror having a  
9 reflecting surface and a nominal datum line extending along its longitudinal  
10 dimension;  
11 at least one interferometer subsystem mounted in a predetermined manner  
12 with respect to said at least one thin, elongated mirror; adapted to cooperate with said  
13 at least one thin, elongated mirror to measure the displacement of said translation  
14 stage in at least one azimuth; and adapted to measure the local slope of said at one  
15 thin, elongated mirror along and orthogonal to its datum line and its local  
16 displacement normal to said reflecting surface;  
17 control means having a mode of operation for selectively translating said  
18 translation stage, said at least one thin, elongated mirror and said at least one  
19 interferometer subsystem moving relative to one another in said mode of operation so  
20 that said at least one interferometer subsystem scans said at least one thin, elongated  
21 mirror along its corresponding datum line to generate a signal containing information  
22 indicative of the angular change and surface departure of said reflecting surface  
23 thereof along with any contributions thereto due to variations present from said  
24 electro-mechanical arrangement per se; and  
25 signal and analysis means for extracting said information contained in said  
26 signal and determining the local shape of said at least one thin, elongated mirror while  
27 said control means is in said mode of operation.

1 2. The interferometric apparatus of claim 1 wherein said at least one thin,  
2 elongated mirror is mounted to said translation stage for movement therewith and said  
3 at least one interferometer subsystem is fixedly mounted off said translation stage.

1           3. The interferometric apparatus of claim 1 wherein said at least one  
2 interferometer subsystem is fixedly mounted to said translation stage for movement  
3 therewith and said at least one thin, elongated mirror is fixedly mounted off said  
4 translation stage.

1           4. The interferometric apparatus of claim 1 wherein said control means is  
2 structured and arranged to have another mode of operation in which the motion of  
3 said translation stage is measured in at least one azimuth with respect to said  
4 reference frame.

1           5. The interferometric apparatus of claim 1 comprising at least two, thin  
2 elongated mirrors having reflecting surfaces orthogonally arranged with respect to one  
3 another and each including a nominal datum line extending along its longitudinal  
4 dimension and at least two interferometer subsystems at least in part mounted off  
5 said translation stage, each of said at least two interferometer subsystems being  
6 adapted to scan a corresponding one of said thin, elongated mirrors and configured to  
7 measure the local slope of the scanned mirror along and orthogonal to its datum line  
8 and its local displacement normal to said reflecting surface, said control means being  
9 further configured in said mode of operation to selectively translate said translation  
10 stage in one or all of its possible directions of motion so that at least one of said  
11 interferometer subsystems scans a corresponding one of said thin, elongated mirrors  
12 along its corresponding datum line to generate a signal containing information  
13 indicative of the angular change and surface departure of its corresponding reflecting  
14 surface along with any contributions thereto due to variations present from said  
15 electro-mechanical arrangement per se while the other of said interferometer  
16 subsystems generates a signal containing at least information about the angular  
17 change of said translation stage, said signal combining and analysis means extracting  
18 information contained in said signals and determining the local shape of said at least  
19 two thin, elongated mirrors.

          6. The apparatus of claim 1 wherein said at least one interferometer  
subsystem comprises a single beam plane mirror interferometer subsystem.

1 7. The interferometric apparatus of claim 1 wherein said interferometric  
2 apparatus comprises three orthogonally arranged thin, elongated mirrors and three  
3 corresponding interferometer subsystems mounted for relative motion with respect to  
4 one another while said control means is in said mode of operation to measure the  
5 local shape of said mirrors in three dimensions.

8. The interferometric apparatus of claim 1 further including a  
photolithographic wafer mount located on said translation stage for movement  
therewith.

9. The interferometric apparatus of claim 8 further including a  
photolithographic exposure unit fixedly mounted to said reference frame for forming  
masked patterns on wafers located on said translation stage.

1 10. Interferometric method comprising the steps of:  
2 defining a reference frame;  
3 providing a translation stage for movement with respect to said reference  
4 frame;  
5 selectively translating said translation stage in at least one of at least two  
6 orthogonal directions with respect to said reference frame;  
7 mounting at least one thin, elongated mirror in a predetermined manner with  
8 respect to said reference frame, said at least one thin, elongated mirror having a  
9 reflecting surface and a nominal datum line extending along its longitudinal  
10 dimension;  
11 mounting at least one interferometer subsystem in a predetermined manner  
12 with respect to said at least one thin, elongated mirror where said at least one  
13 interferometer subsystem is adapted to cooperate with said at least one thin,  
14 elongated mirror to measure the displacement of said translation stage in at least one  
15 azimuth and is also adapted to measure the local slope of said at one thin, elongated  
16 mirror along and orthogonal to its datum line and its local displacement normal to said  
17 reflecting surface;  
18 selectively translating said translation stage in a mode of operation in which  
19 said at least one thin, elongated mirror and said at least one interferometer subsystem  
20 move relative to one another in said mode of operation so that said at least one

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21 interferometer subsystem scans said at least one thin, elongated mirror along its  
22 corresponding datum line to generate a signal containing information indicative of the  
23 angular change and surface departure of said reflecting surface thereof along with  
24 any other contributions thereto due to variations present during said step of selectively  
25 translating said translation stage; and

26 extracting said information contained in said signal and determining the local  
27 shape of said at least one thin, elongated mirror while is in said mode of operation.

1 11. The interferometric method of claim 10 wherein said at least one thin,  
2 elongated mirror is mounted to said translation stage for movement therewith and said  
3 at least one interferometer subsystem is fixedly mounted off said translation stage.

1 12. The interferometric method of claim 10 wherein said at least one  
2 interferometer subsystem is fixedly mounted to said translation stage for movement  
3 therewith and said at least one thin, elongated mirror is fixedly mounted off said  
4 translation stage.

1 13. The interferometric method of claim 10 having another mode of operation  
2 in which the motion of said translation stage is measured in at least one azimuth with  
3 respect to said reference frame.

1 14. The interferometric method of claim 10 in which there are provided at  
2 least two, thin elongated mirrors having reflecting surfaces orthogonally arranged with  
3 respect to one another with each including a nominal datum line extending along its  
4 longitudinal dimension and at least two interferometer subsystems at least in part  
5 mounted off said translation stage, each of said at least two interferometer  
6 subsystems being adapted to scan a corresponding one of said thin, elongated  
7 mirrors and configured to measure the local slope of the scanned mirror along and  
8 orthogonal to its datum line and its local displacement normal to said reflecting  
9 surface, said method being further configured in said mode of operation to selectively  
10 translate said translation stage in one or all of its possible directions of motion so that  
11 at least one of said interferometer subsystems scans a corresponding one of said  
12 thin, elongated mirrors along its corresponding datum line to generate a signal  
13 containing information indicative of the angular change and surface departure of its

14 corresponding reflecting surface along with any contributions thereto due to variations  
15 present from any other contributions present during said step of selectively translating  
16 said translation stage while the other of said interferometer subsystems generates a  
17 signal containing at least information about the angular change of said translation  
18 stage, said step of extracting information contained in said signals determining the  
19 local shape of said at least two thin, elongated mirrors.

15. The interferometric method of claim 10 wherein said at least one interferometer subsystem comprises a single beam, plane mirror interferometer subsystem.

1 16. The interferometric method of claim 10 in which there are provided three  
2 orthogonally arranged thin, elongated mirrors and three corresponding interferometer  
3 subsystems mounted for relative motion with respect to one another while in said  
4 mode of operation to measure the local shape of said mirrors in three dimensions.

17. The interferometric method of claim 10 further including the step of mounting a photolithographic wafer on said translation stage for movement therewith.

1 18. The interferometric method of claim 17 further including  
2 photolithographically exposing said wafer from said reference frame with masked  
3 patterns of illumination.